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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/992,462	11/16/2001	Chris W. Hill	98090DIV	8205

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EXAMINER	
SOWARD, IDA M	

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 03/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/992,462	HILL, CHRIS W.	
	Examiner	Art Unit	
	Ida M Soward	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the Applicant's amendment filed November 24, 2003.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-2, 5 and 14-15 are rejected under 35 U.S.C. 102(e) as being anticipated by Ravi (5,807,785).

Ravi teaches a method of forming a dielectric layer in an opening, comprising: forming a first dielectric layer 62 in the opening G, the opening having an aspect ratio

greater than about two, and wherein a portion of the opening not filled with said first dielectric layer has an aspect ratio of not greater than about two; and forming a second dielectric layer 64 over the first dielectric layer, the second layer filling the portion of the opening not filled with the first dielectric layer and having a top surface that is not within the opening such that voids are substantially not present in the opening. In regard to claims 2 and 5, Ravi further teaches providing a substrate before forming the opening; and forming a first dielectric layer includes forming the first dielectric layer having a top surface that is within the opening. In regard to claim 14, Ravi teaches providing a substrate; forming an opening relative to the substrate, the opening having an aspect ratio greater than about 2; forming a first dielectric layer in the opening, wherein a portion of the opening not filled with said first dielectric layer has an aspect ratio of not greater than about two; and forming a second dielectric layer over the first dielectric layer; the second layer filling the portion of the opening not filled with the first dielectric layer and having a top surface that is not within the opening such that voids are substantially not present in the opening. In regard to claim 15, Ravi teaches forming an opening includes forming an opening in the substrate (Figure 3, cols. 8-9, lines 57-61 and 1-59, respectively).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3, 7-8, 16-19 and 20-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) as applied to claims 1-2, 5 and 14-15 above, and further in view of Kocmanek et al. (5,252,520).

Ravi teaches all mentioned in the rejection above. However, Ravi fails to teach and first dielectric layer having a first process setting, at least one of the first and second layer the opening such that voids are substantially not present in the opening; the second and final dielectric layer having a second process setting at a predetermined relationship with the first process setting; forming an opening including forming an opening on the substrate; forming a plurality of structures on the substrate so that the plurality of structures forms an opening; forming a plurality of structures including forming a plurality of conductors. Kocmanek et al. teach a method of forming a dielectric layer during the manufacture of a semiconductor device, comprising: first dielectric layer having a first process setting, at least one of the first and second layer the opening such that voids are substantially not present in the opening; and the second and final dielectric layer having a second process setting at a predetermined relationship with the first process setting (col. 2, lines 1-22); forming an opening including forming an opening on the substrate; forming a plurality of structures on the substrate so that the plurality of structures forms an opening; forming a plurality of structures including forming a plurality of conductors 15 (Figure 1, cols. 1-2, lines 63-68 and 1-41, respectively). In regard to claims 8 and 20-25, Kocmanek et al. further teach dielectric layer 17 and 21 grown by different CVD process settings. Therefore, it is

within the level of ordinary skill to form the first and second dielectric layers at first and second temperatures, pressures, dopant concentrations, dopant flow rates and shower head distances because the first **17** and second **21** dielectric layers growth process settings are different (Figure 1, col. 2, lines 2-68). Since Ravi and Kocmanek et al. are from the same field of endeavor (method of forming dielectric layers in openings), the purpose disclosed by Kocmanek et al. would have been pertinent in the art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening of Ravi with process settings and plurality of structures as taught by Kocmanek et al. to eliminate the problem of chemical attack and water absorption (col. 1, lines 28-46).

Claims 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) as applied to claims 1-2, 5 and 14-15 above, and further in view of Chou et al. (5,861,345).

Ravi teaches all mentioned in the rejection above. However, Ravi fails to teach a first dielectric layer having a top surface that is not within the opening. Chou et al. teach a first dielectric layer 126 having a top surface that is not within the opening 122 (Figure 3C, col. 4, lines 21-67). Since Ravi and Chou et al. are from the same field of endeavor (method of forming dielectric layers in openings), the purpose disclosed by Chou et al. would have been pertinent in the art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening as taught by Ravi with the first

dielectric top surface as taught by Chou et al. to eliminate delamination due to poor adhesion (col. 3, lines 27-30).

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) as applied to claims 1-2, 5 and 14-15 above, and further in view of Lin (5,969,409).

Ravi teaches all mentioned in the rejection above. However, Ravi fails to teach forming a dielectric layer completely filling an opening. Lin teaches forming a dielectric layer **3** completely filling an opening **2** (Figures 2-7, cols. 7-8, lines 48-67 and 1-7, respectively). Since Ravi and Lin are from the same field of endeavor (method of forming dielectric layers in openings), the purpose disclosed by Lin would have been pertinent in the art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening as taught by Ravi with forming the dielectric layer completely filling an opening of Lin to decrease process complexity (col. 3, lines 22-36).

Claims 6, 9-13 and 27-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) as applied to claims 1-2, 5 and 14-15 above, and further in view of Jang et al. (5,563,104).

Ravi teaches all mentioned in the rejection above. However, Ravi fails to teach forming first and second dielectric layers through an ozone-TEOS deposition; and first and second process settings selected from a group consisting of temperature, reactor chamber pressure, dopant concentration, flow rate, and shower head spacing. Jang et

al. teach forming first **16** and second **18** dielectric layers through an ozone-TEOS deposition. Jang et al. further teach forming the first dielectric layer at a first process setting and forming a second dielectric layer at a second process setting at a predetermined relationship with the first process setting, wherein the first and second process setting consists of first and second temperatures (Figure 2, col. 2, lines 16-52). Also, it is within the level of ordinary skill to form the first and second dielectric layers at first and second temperatures, pressures, dopant concentrations, dopant flow rates and shower head distances because the first **16** and second **18** dielectric layers of Jang et al. are different thickness which requires different process settings. Since Ravi and Jang et al. are from the same field of endeavor (method of forming dielectric layers in openings), the purpose disclosed by Jang et al. would have been pertinent in the art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening as taught by Ravi with forming the ozone-TEOS layers of Jang et al. to reduces pattern sensitivity (col. 1, lines 48-51).

Response to Arguments

Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents are cited to further show the state of the art with respect to the method of forming dielectric layers in an opening:

Chen (5,453,406)	Fan et al. (US 6,171,885 B1)
Kishimoto et al. (6,093,637)	Losavio et al. (5,543,633)
Lou (6,020,265)	Lou et al. (5,932,487)
Narwankar et al. (US 6,200,911 B1)	Roche et al. (5,913,149)
Sultan et al. (5,382,547)	Yang (5,656,556).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ida M Soward whose telephone number is 571-272-1845. The examiner can normally be reached on Monday - Thursday, 6:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ims
February 17, 2004

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